FORESTRY RESEARCH

WHAT'S NEW IN THE WEST JULY 1975

U.S. Department of Agriculture Forest Service

a note to you

On the cover—Herb Shields, engineer with the Forest Service's San Dimas Equipment Development Center in California, is leader of the night helitack research project (see story, page 1).

FORESTRY RESEARCH: What's New in the West, is a report on the work of the USDA Forest Service's four Forest and Range Experiment Stations in the West. These research centers, and the states included in their areas of study, are: Rocky Mountain (North Dakota, South Dakota, Nebraska, Kansas, Colorado, Arizona, New Mexico, and part of Wyoming, Oklahoma, and Texas); Intermountain (Montana, Idaho, Utah, Nevada, and part of Wyoming); Pacific Northwest (Alaska, Oregon, and Washington); and Pacific Southwest (California, Hawaii, Guam, and American Samoa).

some credits

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Cover photo by Conrad E. Bluhm, Los Angeles County Fire Department. Back cover photo of an Abert squirrel courtesy Utah Division of Wildlife Services.

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Pilots try night helitack

Wearing special goggles that enable them to see in the dark, helicopter pilots will make night flights over wildfires in southern California this year. If their test runs are as successful as the ones they made last fire season, night helitack will be on the way to becoming a weapon fire bosses can rely on in planning their fire attack strategy.

The flights will be made as part of a research program sponsored by the Pacific Southwest Forest and Range Experiment Station, the San Dimas Equipment Development Center (both: USDA Forest Service), the Los Angeles County Fire Department, and other agencies that are interested in improving night firefighting.

A member of the program's coordinating committee once said the group's intention is "to do away with night. We want to eliminate the restrictions that nightfall ordinarily inflicts on the fire boss. At the same time, we want to help him take advantage of the lower temperatures and wind speeds that usually exist on wildfires at night."

The committee's approach has been to train turbine-qualified helicopter pilots to safely navigate to wildfires at night. Of all the night vision devices that the men working on the program have looked into, the goggles developed for the military by ITT have been the most useful. These battery-operated units are compact and are completely self-contained. The goggles weigh less than 2 pounds and can be mounted on helmets worn by the copter pilot and co-pilot. The units amplify starlight, moonlight, or artificial light, giving the pilots a view of whatever's ahead. Most pilots need to work with the goggles for about 5 hours before they become adept at picking up visual cues from the unfamiliar, all-green world they see on the miniature viewing screens contained in the goggles.

Some of the test pilots have also worked with a FLIR—forward-looking infrared, installed in a UH-1M Bell (Huey) that the U.S. Army loaned to the night helitack project. With FLIR, pilots can look at video screens in the cockpit to see a daylight picture of whatever is in the infrared scanner's

▼ Night vision goggles amplify starlight and moonlight.

field of view. The FLIR works day and night, penetrates smoke and haze, and has only one serious limitation—it isn't usable in heavy fog or a similar weather condition.

Even though the copter will be returned to the Army, FLIR will continue to be a part of the night vision research: This spring, a new FLIR will be placed inside one of the ships owned by the Los Angeles County Fire Department. A featherweight compared to its bulkier predecessors, this new FLIR will be TV-compatible—whatever the pilots see can be recorded for playback at the fire camp or at a training session.

In addition to the night vision goggles and FLIR, program pilots have also experimented with an infrared light that was attached to the underside of the Huey. Pilots reported that the light was great for illuminating canyons and other places where there wasn't adequate starlight or moonlight.

Another piece of auxiliary equipment that has worked out well is the TALAR IV (Tactical Landing Air Radar) portable instrument landing system. With TALAR, pilots who are landing at a forest helispot can receive instrument landing guidance similar to that provided at a city airport.

Copter in action

Last year, pilots made night flights to four wildfires—the Devils Canyon, Texas Canyon, and Prospect Fires on the Angeles National Forest; and the Soboba Fire on the San Bernardino. Of the four, the Soboba missions were the best demonstration of the potential of night helitack. The crew flying on that fire made about 50 water drops (most of which were on target) and won some friends, among them sector boss Bob Tinker and air attack boss Bob Irwin.

If anyone has the right to throw cold water on the night helitack program, it's Tinker. He was caught unawares by one of the first drops made by the night copter crew and got a soaking. Tinker, however, has nothing but good words for the night copter. "The night copter crew helped us to work a section of line that otherwise would have been impossible to handle," he claims. And air boss Bob Irwin is just as enthusiastic. "The next time I've got anything to do with the management of a large fire, that night helicopter is going to be part of the action," he says.

The only thing that went really wrong on the Soboba was that the night crew unwittingly doused a backfire that ground crews were trying to start. The incident was more annoying than anything else, but it did emphasize the importance of setting up a communication network between the night air support, the night ground support, and the sector boss. "We're working on it," says Herbert J. Shields, engineer at the Forest Service's San Dimas Equipment Development Center and manager of the night copter project. "We want the night helitack package to fit neatly into fire fighting organizations.

Other applications

"Although our main concern right now is with night operations for fire surveillance and for delivery of water, retardant, crews, and equipment, we realize that there are a lot of other practical applications of the night vision research. People have told us, for example, that night crews could help with search and rescue missions, emergency medical evacuation, and wildlife surveys.

"There's a good possibility that airplane pilots who are delivering smokejumpers and paracargo could use the night vision systems, too."

In addition to the Forest Service and the Los Angeles County Fire Department, agencies who are backing the experiment include: U.S. Department of the Interior, Bureau of Land Management; U.S. Department of Defense, Army and Air Force; State of California Division of Forestry; State of Oregon Department of Forestry; the Aerospace Corporation; and Western Helicopters, Inc.

For further information on the night helitack operations, please write to Herb Shields at the San Dimas Equipment Development Center, USDA Forest Service, 444 East Bonita Avenue, San Dimas, California 91773, or phone him at (213) 332-6231 or (714) 599-1267. □

Designing with desk-top calculators

The PNW Experiment Station's Forest Engineering Laboratory in Seattle, Washington, has achieved a major advancement in logging engineering technology by using desk-top calculators. The compact Hewlett-Packard 9830 calculator, together with a high-speed printer, electronic digitizer, and plotter, can now be programmed for road planning and harvest unit design.

The basic cost of the system runs about $20,000. But even in today's inflated economy, that buys a lot of analytic and design capability. According to Hilton Lysons, project leader at Seattle, the H-P 9830 system can significantly aid the logging engineer in expanding his design capability.

The Engineering Laboratory acquired their first desk-top calculator, an H-P 9100, in 1969 to use in skyline logging design. But they could see then that this approach had other applications in forestry—perhaps in road design, timber sale appraisal, and forest surveying. Since then, the group has developed seven computer programs for skyline engineering and five for road planning and design.

"Technology has a long history of advancing to meet the needs of the times," Lysons says. "Today's environmental constraints, plus the energy crisis, are forcing us to look at new ways to get our job done. The calculator lets the user properly consider the total systems requirements in developing the best logging and road plan."

Ward Carson, an engineer at the Laboratory,

(continued on page 16)

▼ Logging engineer Doyle Burke uses a digitizer to get road locations into the computer for analysis.

▲ Lodgepole stands, combined with natural openings and dispersed trees, form diverse forest environments.

Lodgepole–a versatile tree

What is known about lodgepole pine and where can I get the information? This question led to one of the most complete discussions of management of a forest species ever held—the Lodgepole Pine Symposium at Washington State University in October, 1973.

Copies of the proceedings, published by Washington State University and edited by Dr. David M. Baumgartner, are now available from the University at $9.50 per two-volume set. Volume I contains 38 papers that cover the major topics of the symposium—the resource, productivities, factors influencing productivities, and management and utilization. The second volume, a bibliography developed by Dr. James E. Lotan of the Intermountain Forest and Range Experiment Station, lists over 1,100 references on lodgepole pine. It includes research reports from 1954 to October 1973.

The symposium proceedings bring together much of what is known about lodgepole pine and its management. The publication should tell you what is known about the most common management problems, and where you can find more detailed information.

The proceedings may also present a few surprises about the species. For example, did you know that lodgepole pine has one of the greatest ranges of any conifer in western North America? Lodgepole pine forests cover almost 69 million acres in the United States and Canada. Lodgepole

has been planted widely in Great Britain and New Zealand and to a lesser extent in Finland, Argentina, Poland, the Netherlands, and Norway. Planting in the United States is relatively new, but it is growing in importance.

The lodgepole pine is a versatile tree. It has been used for a longer time and has provided a greater variety of products than any other western tree species. Indians used the slim poles in their tepees and lodges—hence the name. Pioneers built homesteads and fences and shored their mines with the timbers from the tall, slender tree. And most of the railroad crossties in the Rocky Mountain country were cut from lodgepole pine.

Lodgepole pine has many characteristics that can be both bane and blessing. For example, it regenerates well, but many stands soon become overstocked and stagnated. It is highly susceptible to mountain pine beetle infestations and is subject to lingering death by dwarf mistletoe.

The species has excellent reseeding power, often aided by fire. While natural seed dispersal is somewhat limited, cones that are on the ground open readily when subjected to fire.

The reseeding success of the cones is fantastic —lodgepole has had recorded stocking levels as high as 500,000 stems per acre in young stands and as many as 100,000 stems per acre in a 70-year-old stand. Both stocking levels are so dense that the stems cannot develop into good trees without first being thinned.

Only the small size of lodgepole pine trees at maturity delayed its entry into the commercial timber market. However, developments in harvesting and milling technology, together with increased demands for lumber supplies, have improved the economic picture for lodgepole pine timber. The annual harvest of lodgepole pine is now more than 300 million cubic feet per year in the United States and Canada.

As the demand for lodgepole increased during the last two decades, forest managers saw the opportunity to convert old, deteriorating forests into young ones. Most people welcomed the new attitude toward the lodgepole pine stands. The lumber industry, for example, quickly built timber-processing plants near timber supply centers. A wave of timber-harvesting activity in this "new resource" followed, and is continuing.

Aside from its commercial value, lodgepole pine is the major tree cover in many scenic and recreation areas of the West. Most of the campsites in Yellowstone National Park are in lodgepole pine stands, and the tree is the dominant species at Banff National Park in Canada.

Not to be ignored is the role of the lodgepole pine forests as a protective cover for and regulator of waterflow. Lodgepole pine commonly occurs as a primary component of the forest cover in major mountain watersheds.

Extensive stands of mature lodgepole pine may not be favorable for many forms of wildlife. However, where a forest is managed for timber production, with a variety of age classes, the fish and wildlife habitat can be ideal.

These facts, and many more, are incorporated into the proceedings.

For more information, write to Lodgepole Pine, Conference Coordinator, Cooperative Extension Service, Ag Phase II, Washington State University, Pullman, Washington 99163. □

▼ Lodgepole is a major species in many recreation areas.

Ponderosa pine and Abert squirrels

Logging is changing the habitat of Abert squirrels *(Sciurus aberti aberti* Woodhouse*)* in the ponderosa pine forests of the Southwest. Foresters in that area want to know more about the habitat requirements of the Abert squirrel so they can plan for its needs as they prepare timber sales.

Several years ago, Forest Service land managers in Arizona and New Mexico asked Dr. David R. Patton to identify conditions necessary to maintain Abert squirrel habitat in managed forests. Dr. Patton is project leader and principal research wildlife biologist with the Rocky Mountain Forest and Range Experiment Station at Tempe, Arizona.

"The world of the Abert squirrel is confined to the ponderosa pine forests of Arizona, New Mexico, Colorado, Utah and part of Mexico," Patton explains. "The Abert depends almost entirely on ponderosa pine trees for food and shelter. Gambel oak and forest fungi provide supplemental food where available. In Arizona, the Abert is gaining popularity as a small game animal. Its well-known cousin, the Kaibab squirrel, *(Sciurus aberti kaibabensis)* lives only along the north rim of the Grand Canyon. The Kaibab squirrel is considered a threatened species and is not hunted."

As Dr. Patton analyzed the problem prior to planning his research, it became apparent foresters would need several types of information. They would want a description of the kinds of trees the squirrels seek for food and for nesting. They would also need to understand the forest conditions required around nesting sites.

Dr. Patton chose the Castle Creek drainage in Arizona's Apache National Forest as the place to study feeding habits. Squirrel cuttings (branches and cones) found beneath ponderosa pines along pre-established sample routes were recorded over a 4-year period. Dr. Patton learned that Abert squirrels prefer to feed on mature trees from 11 to 30 inches in diameter. Trees approaching 19 inches proved to be favorites. Growing tips, the inner bark of small branches, and cones provide good eating at different times of the year.

◄ For the study. Abert squirrels are trapped and tagged.

A backpack radio will transmit signals to scientists. ▸

Next he moved to the Beaver Creek drainage of the Coconino National Forest where he designed a sampling system to coincide with existing timber inventory plots. "My objectives here were to determine the physical characteristics of trees that make good nest sites for Abert squirrels, and to describe environmental conditions surrounding nest trees," says Patton.

Using timber inventory points, Patton's crew established a grid to guide their search for squirrel nests. Squirrel habitat existed on much of the 1,800-acre watershed. The crew discovered a total of 414 nests—a density of one nest per 3.9 acres of habitat. They selected 302 of these nests to become center points for 1/10-acre sample plots. Size, age, and degree of dominance of nest trees, and the position of nest trees in relation to surrounding trees in the stand were carefully recorded on each plot. Environmental conditions such as direction of slope exposure, position of the slope (inner, middle, or lower), amount and types of ground cover, density of canopy, and number of trees were also noted on every plot. An analysis of these data is now being prepared for publication.

In speaking about his findings, Dr. Patton points out that "Key factors in Abert squirrel habitat are (1) tree density and basal area near nest sites, (2) tree grouping, (3) position of the nest tree crown in the canopy, and (4) size of trees in which squirrels nest and feed.

"Our data indicate best overall nesting conditions are found in ponderosa pine stands of 200 to 250 trees per acre, or the equivalent of that density for areas less than an acre in size. Average diameter for trees in these stands will probably be 11 to 13 inches. Basal area will be from 150 to 200 square feet per acre.

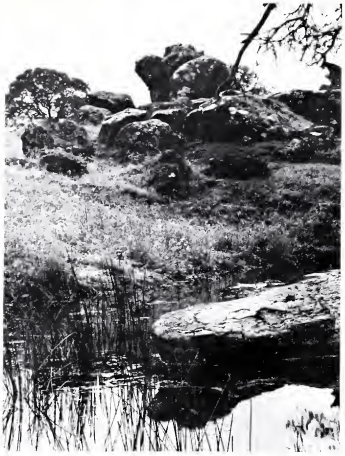
"Squirrels seem to select nest trees near the center of close-knit clumps of pines where interlocking crowns provide a canopy of 80 percent or better above the nest. Nest trees themselves may range from 11 to 22 inches in diameter; trees that are about 15 inches are the preferred size.

"For feeding, Abert squirrels will need to find the slightly larger trees I described earlier," Patton explains. "Ideally, these larger trees would be near the nest site. A mature Gambel oak or two on each acre would also help the food situation.

"The results of our research should give forest managers good ideas for preserving quality squirrel habitat in timber harvest areas. I also believe we should use these results to develop a rating system for squirrel habitat that foresters can easily use as they examine stands in preparation for timber sales," Patton says. "Such a system would permit managers to readily locate sites of different habitat quality. They could then decide how many acres of each quality level to retain in each timber harvest area. Designing this system is our next research task."

For details, write the Rocky Mountain Station for Research Notes RM-169-FR4 ("Abert Squirrels Prefer Mature Ponderosa Pine") and RM-281-FR4 ("Nest Use and Home Range of Three Abert Squirrels as Determined by Radio Tracking"). Research Paper RM-145-FR4, "Abert Squirrel Cover Requirements in Southwestern Ponderosa Pine," will be available by mid-summer. □

Publications



▲ The San Joaquin Range covers 4,500 acres.

Wildlife checklist

Range scientist Don Duncan and wildlife biologist Tom Newman have probably noted just about every major species of reptile, amphibian, mammal, bird, and fish that inhabit the San Joaquin Experimental Range in central California. They've used their field observations in writing "Vertebrate Fauna of the San Joaquin Experimental Range: a Checklist." This publication (General Technical Report PSW-6-FR4) updates a 1955 inventory; copies are available from PSW-Berkeley.

The Range covers 4,500 acres of foothills on the west-side Sierra Nevada. It is an upper Sonoran Zone (annual plant-oak woodland type) community.

Duncan's observations come from 13 years of living at and studying the Range; colleague Newman (now with the Plumas National Forest) spent about one-fourth of his time there.

Reptiles included on their checklist are the Pacific rattlesnake, Pacific gopher snake, Western fence lizard, Gilbert skink, and California whiptail lizard.

Two of the most common types of bats are the Yuma myotis and the California myotis.

The Range supports a variety of mammals, including raccoon, badger, coyote, mule deer, and Audubon cottontail.

Abundant birds on the range are California quail, acorn woodpecker, mourning dove, and scrub jay.

Gully control plan

An inexpensive approach to planning gully control with rock check dams has been devised by Burchard H. Heede, a hydraulic engineer with the Rocky Mountain Station at Tempe, Arizona. Heede was assisted by John G. Mufich, a computer programer. Their technique, based on sediment conditions in the central and southern Rockies, is adaptable to other regions.

Successful tests of Heede's system in Colorado, New Mexico, and Arizona have shown that a variety of treatments for a single gully, or series of gullies, can be rapidly designed by computer. The computer program has two phases—one for overall treatment design and one for detailed construction planning.

Phase one requires only a few simple field measurements and office calculations. The results are (1) an array of treatment designs for the gully system, i.e., alternative combinations of construction methods, numbers, and sizes of dams that will do the control job; (2) the cost of installing each combination of dams; and (3) the benefits of each combination, i.e., the cost to remove sediment from a downstream reservoir if check

dams are not installed. With this information, the resource manager can select the treatment design and the type or types of dam construction that will best meet the manager's objectives and constraints. Phase one may also be used to inventory gully control needs for land use and budget planning purposes.

Once the manager has selected a treatment approach, phase two requires only a few additional measurements from each dam site recommended by phase one. Phase two yields detailed construction plans, costs, and benefits for each dam to be built.

Design relationships used in developing the computer program, a description of the program, and an illustration of its use are in "Functional Relationships and a Computer Program for Structural Gully Control," *Journal of Environmental Management* 1(4):321-344. Instructions for using the program, and key equations involved, are in "Field and Computer Procedures for Gully Control by Check Dams," *Journal of Environmental Management* 2(1):1-49. Reprints of both articles are available from the Rocky Mountain Forest and Range Experiment Station in Fort Collins, Colorado.

Wilderness wildfires

Preoccupation with prevention and suppression of wildfires sometimes obscures the fact that fire has a natural role—that it is an important link in the complex chain of life in wildland forest areas.

The Wilderness Act of 1964 opened the door to fire managers to plan new strategies for dealing with fire in Wilderness Areas—fire that would be compatible with the managers' goal of perpetuating natural and unmodified ecosystems.

In 1970, the White Cap Wilderness Fire Management Study was begun in the Idaho portion of the Selway-Bitterroot Wilderness, Bitterroot National Forest, Montana. The administrative study, paid for with funds from the USDA Forest Service's fire management budget, was a cooperative effort between the National Forest System, Forest Service Research, and the University of Montana. The goal—to incorporate the natural role of fire into a new fire management plan for the Selway-Bitterroot Wilderness.

Land managers and researchers divided the 100-square-mile study area into five management zones, according to the ecology of each. They then set up specific fire management prescriptions for each zone. These prescriptions provide line officers and dispatchers with guidelines that state what will be done with fire and when different actions will be taken. Time of year, location of the fire, and fire-danger rating are key considerations. This program is now operational in part of the Selway-Bitterroot Wilderness and is expanding to other areas.

Two of the objectives of the fire plans are to provide for the safety of people, and to prevent major adverse effects from occurring outside the Wilderness Area. Beyond this, fire managers may decide to let a fire take its course.

Management plans that treat fire as a natural occurrence have been made by other organizations. The National Park Service, for example, has used natural fire management strategies in Sequoia, Kings Canyon, Grand Teton, Yellowstone, and other National Parks.

The White Cap Study was directed by Robert W. Mutch of the Northern Forest Fire Laboratory, Intermountain Forest and Range Experiment Station; and David F. Aldrich of the Bitterroot National Forest. For more information, see the following articles: "Wilderness Fires Allowed to Burn More Naturally," by D. F. Aldrich and R. W. Mutch, *Fire Control Notes* 33(1):3-5; "Fire-dependent Forests in the Northern Rocky Mountains," by J. R. Habeck and R. W. Mutch, *Quaternary Research* 3(3):408-424; and "I Thought Forest Fires Were Black!" by R. W. Mutch, *Western Wildlands* 1(3):16-21.

Slope stability

Logging activities have sometimes been responsible for accelerating landslides and erosion on steep slopes in the Western United States. Road construction on unstable terrain is the primary problem, with the hazards being greatest during or following heavy rains. Foresters and engineers try to avoid situations where watershed damage is likely to occur. In addition, they continually seek new techniques and information which will help them to minimize soil disturbance and erosion.

In a paper presented in Russia in 1971, geologist D. N. Swanston of the PNW Station in Corvallis, Oregon, summarized the current knowledge and research in this field. That report has now been updated and published as General Technical Report PNW-21-FR4, "Slope Stability Problems Associated with Timber Harvesting in Mountainous Regions of the Western United States."

In the report, Swanston indicates that identification of hazardous sites is probably the most useful approach to the problem right now. Techniques now in use in Alaska and northern California can be applied throughout the United States, if the land manager has adequate knowledge of local site conditions and erosion processes.

In California, aerial photographs are being used to identify, delineate, measure, and interpret topographic features related to deep-seated soil creep and sliding. Geologic maps compiled from surface outcrops and drill cuttings aid in interpretation. Vertical color-infrared photos help identify wet areas that are especially vulnerable to slipping. Special maps are being used to evaluate soil creep and landslide potential.

In southeast Alaska, aerial photo interpretation has also been used, especially in locating areas subject to debris avalanches. Maps of slope angle are particularly useful in Alaska because slope gradient is a key factor in stability. In Alaska, also, there is a strong relationship between areas of high rainfall and debris avalanches.

Some attempts have been made to stabilize disturbed areas, but these techniques are difficult and expensive to use, and don't always work. It is better to avoid disturbance in the first place. Swanston recommends the following: (1) careful design of forest roads to avoid placing them on potentially unstable slopes; (2) proper choice of timber harvest equipment and methods; and (3) use and development of balloon logging, helicopter logging, and other new harvesting methods which minimize soil disturbance.

Rocky Mountain forests

Silviculturists at the Rocky Mountain Station have summarized "the status of our knowledge" about major forest types from the Black Hills to the Southwest. The result is a series of five papers that capsulize more than 60 years of forest management research in South Dakota, Wyoming, Colorado, New Mexico, and Arizona.

Four of these papers are state of the art reviews that cover (1) ponderosa pine in the Black Hills, (2) subalpine forests in the central and southern Rockies, (3) southwestern mixed conifers and aspen, and (4) southwestern ponderosa pine. The fifth paper is a 36-page overview, entitled, "Silviculture of Central and Southern Rocky Mountain Forests: A Summary of the Status of Our Knowledge by Timber Types," (Research Paper RM-120). Robert R. Alexander, research forester at Fort Collins, Colorado, wrote this summary paper for busy administrators who don't have the time to read each of the reports in the series. He includes summaries on the silviculture of each timber type, discusses management practices, and points out needs for additional research.

For specialists in silviculture and timber management, the other reports in the series contain information that may help them solve specific forest management problems. Each

report contains a thorough list of references. And, as with the overview, each paper concludes with an inventory of areas in which research is still needed.

Black Hills ponderosa pine

Research foresters Charles E. Boldt and James L. Van Deusen at Rapid City, South Dakota, teamed up to write "Silviculture of Ponderosa Pine in the Black Hills: The Status of Our Knowledge" (Research Paper RM-124). Major sections in their paper contain descriptions of the life history and behavior of the species; the effects that damaging agents such as insects, disease, fire, weather, and animals have on forest stands; and the influence of soil and topography on forest development.

In their section on silvicultural prescriptions and management techniques, Boldt and Van Deusen discuss such topics as silvicultural condition class descriptions and treatments, ways to cut to obtain regeneration, guides to intermediate cutting in managed stands, and reforestation techniques.

Subalpine forests in the Rockies

Robert R. Alexander compiled "Silviculture of Subalpine Forests in the Central and Southern Rocky Mountains: The Status of Our Knowledge" (Research Paper RM-121). The paper is divided to treat two major forest types: the lodgepole pine type and the Engelmann spruce-subalpine fir type of Wyoming, Colorado and northern New Mexico. These types are the leading timber producers in Wyoming and Colorado.

Alexander first provides an overall description of subalpine forests within the three-state territory. Major topics here include climate, geology, soils and landforms, life zones, succession, and plant communities. He also reviews the amount and quality of the timber resource in the subalpine forest.

In the remainder of the paper he discusses the spruce-fir type and lodgepole type separately. For each discussion, his major topics are characteristics of the type, past cutting history, damaging agents, requirements for natural regeneration, determination of site quality, growth and yield potential, silviculture and management for old-growth forests, and management of young forests.

▼ Black Hills ponderosa pine responds to thinning.

Mixed conifer and aspen forests

John R. Jones, research forester at Flagstaff, Arizona, has pulled together information on "Silviculture of Southwestern Mixed Conifers and Aspen: The Status of Our Knowledge" (Research Paper RM-122). Jones defines these forests as a combination of Douglas-fir, ponderosa pine, white fir, Engelmann spruce, aspen, southwestern white pine, blue spruce, and corkbark fir growing together, often in more or less that order of abundance.

Jones concentrates his discussions on mixed conifer forests of Arizona, New Mexico, and southwestern Colorado. He begins with a description of their composition and their distribution. He then turns to ecological factors, such as moisture, temperature, light, wind, biotic agents, and fire, with a discussion of their influence on silvicultural practices.

He devotes the rest of his paper to sections on unique characteristics of species that comprise mixed conifer, successions and climaxes, ecosystem classification, typical stand structures, and applicable silvicultural practices. In the silvicultural section, Jones deals with methods for obtaining reproduction, and intermediate practices useful in maintaining or improving the growth and condition of existing stands.

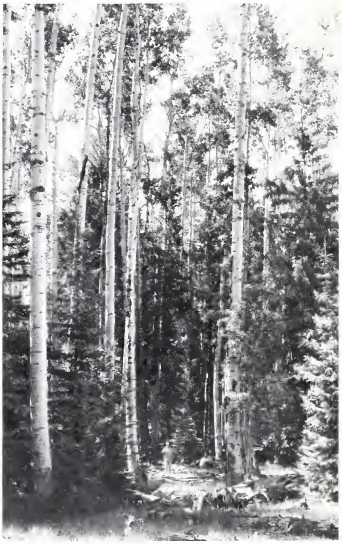
Southwestern ponderosa pine

Research forester Gilbert H. Schubert of Flagstaff, Arizona, has completed "Silviculture of Southwestern Ponderosa Pine: The Status of Our Knowledge" (Research Paper RM-123). In this report, Schubert considers ponderosa pine forests throughout Arizona, New Mexico, Colorado, and Utah. He begins the paper with a historical review of ponderosa pine forestry in the Southwest, and an assessment of the current status of the timber resource in this type.

His comprehensive section on habitat conditions contains descriptions of physiographic features, soil, climate, moisture, light, temperature, succession and climax, plant competition, damaging agents, and site quality as they affect ponderosa pine forests. The next section is a résumé of growth, yield, and wood quality.

Schubert then discusses the silviculture and management of southwestern ponderosa with emphasis on (1) requirements for natural and artificial regeneration, and (2) treatments essential to the development of managed stands that will yield desired end products.

▼ Young mixed conifers developing beneath aspens.



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Research Paper	Stock Number	Price
RM-120	0101-00368	$ .90
RM-121	0101-00381	1.55
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RM-123	0101-00380	1.40
RM-124	0101-00384	1.20

Bibliographies

Two bibliographies that should be of interest to forest land managers are available from the PNW Station.

"A Summary and Annotated Bibliography of Communications Principles," by Ronald E. Dick, David T. McKee, and J. Alan Wagar, appeared in the summer 1974 issue of the *Journal of Environmental Education.*

"An Annotated Bibliography of the Effects of Logging on Fish of the Western United States and Canada," is a General Technical Report (PNW-10-FR4) by Dave R. Gibbons and Ernest O. Salo.

Timber plan aid

Timber management planning requires a lot of information. Summarizing and organizing this information into management plans is time-consuming and expensive. Clifford A. Myers, principal mensurationist at the Rocky Mountain Station's Fort Collins laboratory, has devised a computer technique to reduce the time and cost of this process. Myers' program is known as TEVAP, Timber Evaluation And Planning.

With TEVAP, managers can rapidly process inventory data into tables and summaries and can prescribe management for even-aged as well as two-storied forest stands. The summaries give a detailed description of timber resources within planning units and can be used to compare current volumes with those that will exist when management goals have been attained. More importantly, managers can use TEVAP to calculate (1) allowable cut by area and formula methods; (2) volumes that can be salvaged after fires or insect attacks; and (3) areas and volumes that will need periodic improvement work, if production goals are to be reached.

TEVAP was tested for 2 years on the Black Hills National Forest in South Dakota by an independent team from that Forest and Colorado State University. A summary description of the test is presented in "Computer-Produced Timber Management Plans: An Evaluation of Program TEVAP" (Research Note RM-251-FR4). This publication is available from the Rocky Mountain Station in Fort Collins.

On the basis of this evaluation, Myers revised TEVAP to improve its usefulness under a wider range of conditions than those found in the Black Hills. The new program, TEVAP2, provides data for more working groups and more species than the original program. It also provides a means of accounting for the effects of dwarf mistletoe on forest development. TEVAP2 may be used for (1) ponderosa pine in the Black Hills of South Dakota and Wyoming; (2) ponderosa pine in Arizona and New Mexico; and (3) lodgepole pine in Colorado and Wyoming. The program is easily modified for application to other species. For example, work by Robert R. Alexander, principal silviculturist at Fort Collins, has resulted in the numerical relationships needed to use TEVAP2 in planning management for Engelmann spruce.

A description of TEVAP2, and examples of its use, are in "Computerized Preparation of Timber Management Plans: TEVAP2" (Research Paper RM-115-FR4). For copies, contact the Rocky Mountain Station.

Ponderosa regeneration

Ponderosa pine is the most widely distributed pine in North America, extending from the Fraser River in British Columbia to west-central Mexico and from northeastern Nebraska to the Pacific Coast. Its size, wood properties, and accessibility for logging make it one of the most important pines for lumber use.

This all sounds great—so what's the problem? Today, many of the extensive stands of mature ponderosa are gone. Ponderosa has been a prime target for use since the Gold Rush days and the ensuing settlement of the West. Some cut-over sites have been invaded by chaparral or by other species that don't have the desirable characteristics of the stately ponderosa. In addition, years of fire control have allowed climax species such as Douglas-fir and grand fir to take over sites originally dominated by ponderosa.

The Intermountain Forest and Range Experiment Station has recently published a paper that summarizes present knowledge of natural and artificial regeneration of ponderosa pine, spanning a period of 50 years of research and observations. In "Regeneration of Ponderosa Pine in the Northern Rocky Mountain-Intermountain Region," Marvin W. Foiles and James D. Curtis review the different methods of reproducing the pine in a large geographical region. Copies of their report (Research Paper INT-145-FR4) are available from the Intermountain Station.

Because ponderosa grows under such diverse conditions, there is no single prescription for regeneration. Natural regeneration of the ponderosa is a chancy matter, for the combination of good seed crops and the right moisture conditions doesn't happen very often. Therefore, land managers have often turned to artificial regeneration. The authors stress that with either method, site preparation is the most important consideration.

Site preparation methods have changed dramatically in recent years. To the uninitiated, the sight of a bulldozer methodically creating planting strips might be horrifying. But this type of site preparation, followed by careful planting, has produced ponderosa pine plantations in parts of Utah and Idaho where other efforts over a 30-year period have failed.

Whether artificial or natural regeneration methods are used, the seedlings need about 3 years to become established. Logging damage, fire, disease, and insects lessen the chance that seedlings will survive. Managers watch over their plantings carefully.

Campground study

Popular campgrounds can become dust bowls under the tread of thousands of campers' feet and the treads of hundreds of recreational vehicles. What can the land manager do about it?

Closing campgrounds for a period of recovery shifts the burden to other sites and starts a chain reaction of deterioration. And public reaction to closure of favorite camping spots can be less than ecstatic.

Letting the use continue, but at a reduced rate, may mean recovery will take many years, or might not occur at all.

In 1965, Point Campground, one of the most popular in Idaho's Sawtooth National Recreation Area, was overused and rundown after more than 30 years of heavy camping use. Forest managers decided to close the campground for the 1966 and 1967 recreation seasons for rehabilitation. They also started a cooperative program with Intermountain Forest and Range Experiment Station researchers to find the best methods of rehabilitating the site.

A basic premise was that there was no point in attempting to maintain vegetation on very heavily used parts of the campground. So, roads, trails, parking spurs, and pads beneath the tables, fireplaces, and grills were surfaced with a gravel-asphalt mixture. In areas that were to carry vegetation, underground sprinkling systems were installed.

In 1968, a four-year vegetation rehabilitation study began; and it began with the reopening of Point Campground to public use. Researchers divided the 16 camping units into clusters, and applied various combinations of seed, fertilizer, and water. Forest managers excluded campers during a scheduled sprinkling period once each week. During the 4-year study period, campers made few complaints about the relocation, and many commented favorably on the noticeable improvement in ground cover.

Point Campground now provides a "sustained yield" of benefits to campers in the scenic Recreation Area. The study also shows that cultural treatments of the vegetation can improve a campground while visitors continue to enjoy the area. Wendell G. Beardsley, Roscoe B. Herrington, and J. Alan Wagar outlined the program in an April 1974 *Journal of Forestry* article. More detailed study information is available from the Intermountain Station in USDA Forest Service Research Paper INT-87-FR4, "Improvement and Maintenance of Campground Vegetation in Central Idaho," and in Research Note INT-129-FR4, "Economics and Management Implications of Campground Irrigation."

Herbicide evaluated

In studying the effects of the controversial herbicide 2,4,5-T on the environment, scientists have concentrated mainly on the effect of the chemical itself. But the effects of the contaminant TCDD, which is produced during the synthesis of 2,4,5-T, are much more important.

Even in small quantities, TCDD, (sometimes called dioxin), is highly toxic to fish. In laboratory studies, scientists found that TCDD caused many types of physical damage, fungal growths, loss of interest in feeding, and reduced growth in both guppies and salmon. Growth inhibition was most pronounced in young coho salmon. Scientists want to pin down the threshold level—that point at which harmful effects begin to show up in fish. So far they haven't been able to do that. The smallest quantities of TCDD used in these experiments caused some damage.

Researchers have also recommended a monitoring program to determine how much TCDD is getting into streams and staying there. So far no sampling has been done in either terrestrial or aquatic forest environments. Very sensitive monitoring devices will be necessary.

Spray operations with 2,4,5-T should be carefully laid out with buffer strips along streams and around other bodies of water. Application should be done at times when there is very little wind and wind direction is away from streams and other bodies of water so that contamination of aquatic habitats by drift of herbicides is minimized.

For details, see "Toxicity of TCDD in Aquatic Organisms," a reprint from the September 1973 issue of *Environmental Health Perspectives,* by Richard A. Miller, Logan A. Norris, and Clifford L. Hawkes. Norris and Hawkes are with the Forest Service's Pacific Northwest Forest and Range Experiment Station in Corvallis, Oregon, and Miller is with the Department of Fisheries and Wildlife at Oregon State University.

Desk-top calculators continued

has used the calculator package to improve the design of skyline logging systems. He says recent skyline developments have promoted new interest in this method of logging.

Skyline systems are complex. The logging designer who opts for a skyline system is faced with a multitude of engineering problems, including anchors, allowable deflections, tensions, loads, topography, and the overall capability of the system under consideration. The chances for failure are almost legion and the hazards costly in terms of shutdowns, equipment failures, and hazards to life and property.

But skylines also have some distinct advantages. They can be used to log country that is steep and rugged without causing excessive environmental damage to the slope. Energy requirements are low, especially when compared to the heavy energy demands of helicopter logging, an alternate system for logging steep slopes.

In order to work with skylines, Carson says the logging designer must understand them thoroughly. In the past this was only achieved after long practice and experience in the field. "Now," says Carson, "that experience can be obtained by studying the system through the computer." He claims that any skyline design can now be handled on desk-top computers.

Checking alternatives

"A properly designed computer program puts the designer right into the act," Lysons says. "It enables him to quickly analyze the data, look at all alternatives, and then select the best possible design. That's the only way to meet the environmental constraints in an economical manner. Before the computer, the process of checking out all possible alternatives took so long that by the time you got one design thoroughly analyzed, you said the hell with it and let it go at that.

"The calculator provides the option of checking alternative systems quickly and of determining which system really fits the terrain. With the 9830, it takes about the same time to check all possible alternatives that it used to take to do one design by hand."

Doyle Burke, a logging engineer with the Seattle group, says that planning of timber access roads has always been one of the weak links in logging engineering. "The location and quality of commercial timber and elevation can be determined from aerial photos and topographic maps," Burke says. "Road planning and design information, such as horizontal and vertical curvature and earthwork volumes, are not readily apparent from maps but can be developed with the interactive 9830 calculator system and the road design program package. Road design alternatives can be evaluated at up to 1,000 feet of road per minute."

Instant feedback

George Goddard, forest engineer on the Willamette National Forest in Eugene, Oregon, is impressed with the applications of the 9830 in stump-to-mill total systems planning. The Forest presently has units at Oakridge, McKenzie Bridge, and Sweet Home.

Personnel on the Willamette spent nearly a year debating the pros and cons of the various software systems presently on the market. Goddard talked with representatives from Hewlett-Packard and discussed the function and capabilities of various sytems with the Seattle engineers. The result was a decision to go with the 9830.

According to Goddard, the system is a real benefit in putting sales on the Forest's 5-year action plan. "We can see if we have a go or no go situation, and know right now whether we can put the sale in our plan or not. Later on, we can refine the system for specific sales that we decide to include. The 9830 enables us to examine a lot of alternatives in a very short time.

"The instant feedback of the 9830 approach has made our job of long-range planning an easier one. And, our road and logging designers are planning together in closer association than in the past. It's obvious that the design capabilities of systems such as the H-P 9830 will expand beyond the confines of skyline logging and road design."

Several reports have been prepared on the PNW Station work, and more are in preparation. Write to Publications, Pacific Northwest Forest and Range Experiment Station, and ask for all the current reports by Doyle Burke, Ward Carson, and Hilton Lysons on computer applications in skyline logging and road design. □

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